PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 4 : A23L 1/10, 1/18, A21B 1/42 A21B 5/02 — A1

(11) International Publication Number: WO 88/ 00797

(43) International Publication Date: 11 February 1988 (11.02.88)

(21) International Application Number: PCT/AU87/00239

(22) International Filing Date: 29 July 1987 (29.07.87)

(31) Priority Application Number: PH 7177

(32) Priority Date: 29 July 1986 (29.07.86)

(33) Priority Country: AU

(71) Applicant *(for all designated States except US)*: REAL FOODS PTY. LTD. [AU/AU]; 9 May Street, St. Peters, NSW 2044 (AU).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)* : PELS, Michael [AU/AU]; 9 May Street, St. Peters, NSW 2044 (AU).

(74) Agent: SPRUSON & FERGUSON; G.P.O. Box 3898, Sydney, NSW 2001 (AU).

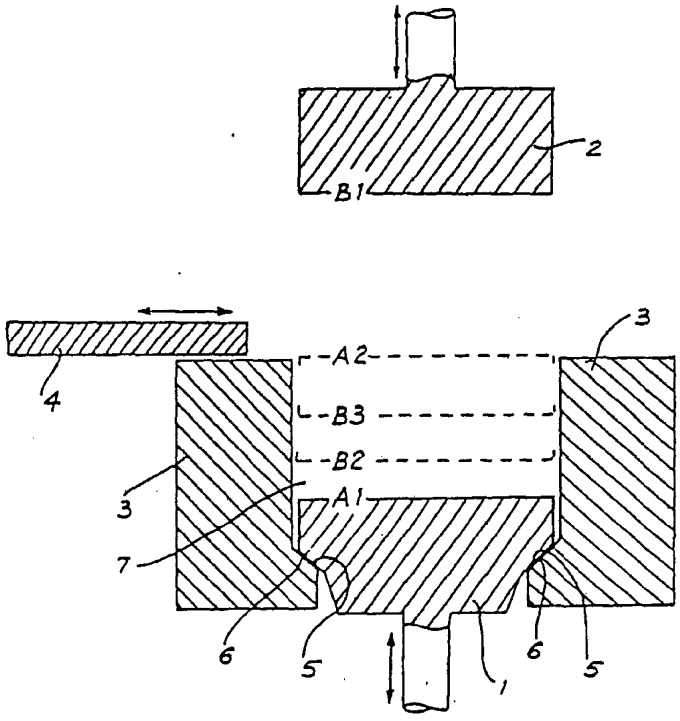
(81) Designated States: AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), LU (European patent), NL (European patent), SE (European patent), US.

Published
With international search report.

(54) Title: RICE CAKE MACHINE

(57) Abstract

The production of a cooked rice cake, or other grain-food products, including the steps of introducing a mixture for the product into a heated mould cavity, compressing the mixture while cooking, momentarily venting steam from the cavity, sharply increasing the cavity during popping of the grain, pausing with said increasing cavity to permit setting of the product, and then opening the mould cavity and removing the product.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	FR	France	ML	Mali
AU	Australia	GA	Gabon	MR	Mauritania
BB	Barbados	GB	United Kingdom	MW	Malawi
BE	Belgium	HU	Hungary	NL	Netherlands
BG	Bulgaria	IT	Italy	NO	Norway
BJ	Benin	JP	Japan	RO	Romania
BR	Brazil	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic			SE	Sweden
CG	Congo	KR	Republic of Korea	SN	Senegal
CH	Switzerland	LI	Liechtenstein	SU	Soviet Union
CM	Cameroon	LK	Sri Lanka	TD	Chad
DE	Germany, Federal Republic of	LU	Luxembourg	TG	Togo
DK	Denmark	MC	Monaco	US	United States of America
FI	Finland	MG	Madagascar		

DESCRIPTION

RICE CAKE MACHINE

TECHNICAL FIELD

This invention relates to a cooking machine, particularly useful in cooking rice cakes, sometimes known as rice wafers. These rice cakes are a puffed rice crispbread type product. The invention is also suitable for the cooking of other forms of grain food.

BACKGROUND ART

Automatic machines for the making of rice cakes are known and incorporate a mould formed by a generally cylindrical continuous, upright side wall with open ends closed by respective end walls reciprocally movable towards and away from each other and which closely fit within the cylindrical wall. Heating elements are included and serve to control the temperature within a predetermined operating range. An uncooked rice mixture is introduced into the mould and crushed before cooking. After a short period to allow for cooking the top end wall is withdrawn at a constant rate until it clears the side wall, and subsequently the cooked rice cake is ejected, or removed, from the mould.

There is a relatively high rejection rate of products from the existing process, due to a deterioration in appearance and texture in some instances. The product is in the shape of a cylindrical cake and the appearance of its upper marginal edge portion is often unacceptable, as well as its texture. This effect appears to result from a sudden drop in pressure upon the cake as the top end wall leaves the side wall.

DESCRIPTION OF THE INVENTION

The present invention has its basis in the theory that a better product should be obtainable with strictly controlled pressure maintained in the mould during cooking, with substantial reduction thereof before the top end wall is completely withdrawn from the mould. As it has been found that at a pedictable point in the cooking cycle the rice seeds "pop", or explode, provision should be made to accommodate this phenomenon.

It is therefore an object of the present invention to provide a cooking machine for rice cakes which will provide a a consistently good product.

In accordance with the present invention there is provided a method of producing a cooked grain-food product such as a rice cake, comprising introducing a cookable mixture for the product into the cavity of a heating mould, applying compression to said mixture by reducing the volume of said

cavity, maintaining said compression for a first period of time, momentarily increasing the volume of said cavity for the venting of steam, maintaining heating of said mixture for a second predetermined period of time, sharply increasing the volume of said cavity at the completion of said second period, pausing in the increase of said volume for a third predetermined period of time before opening said cavity, and then removing the cooked product from said mould.

The invention also provides a cooking machine for a grain-food product, such as a rice cake, comprising a mould defining a cooking cavity and having a tubular side wall and first and second end walls for closing the ends of said side wall;

power means for independently moving said first and second end walls along the axis of said side wall for variation of the volume of said cooking cavity;

heating means for said mould; a three-position solenoid controlled fluid valve controlling said power means for movement of said first end wall; and

an electronic control circuit for controlled energizing of said fluid valve to effect a pause during retraction of said first end wall from said cavity.

In the above described machine it is preferred that the end walls include the heating elements. The second end wall preferably includes an outer tapered periphery which, by interference, seals against a cooperative lip at one end of the side wall with movement of the second end wall towards the lip.

The cross-sectional shape of the end walls will correspond to the cross-sectional shape of the tubular side wall as well as the shape of the rice cake which will generally have a circular or rectangular body.

It is also preferred that the first end wall when fully retracted be sufficiently external of the moulding cavity so as to allow access thereto by a cookable mixture supply tool which, under the control of the control means, provides a measured quantity of cookable mixture to the moulding cavity at the commencement of each cycle.

Another preferred feature is the ability of the second end wall to be raised to a position flush with the entry to the cavity so as to allow quick and easy removal of the cooked product after the cooking cycle.

In the above described method, especially in the case of cooking rice cakes, it is preferred that immediately after the introduction of the cookable mixture end walls of the moulding volume are pressured together so

as to evenly crush the cookable mixture in a heated state so as to fuse together the individual components. The end walls are then "bounced" by being momentarily separated and brought back together in a relative position so as to produce a moulding cavity of a size suitable for the cooking cycle. The purpose of bouncing is to vent steam generated from moisture in the mixture.

The expansion of the moulding cavity after the cooking period is preferably obtained by quick separation of end walls defining the moulding cavity to a relative position defining a larger moulding cavity. This larger moulding cavity is maintained for a short period of time, of from 0.3 to 0.5 seconds, followed by a further quick separation of the end walls. In this final separation the first end wall is completely removed from the moulding cavity while the second end wall is advanced through the side wall so as to allow easy removal of the cooked product.

BRIEF DESCRIPTION OF THE DRAWINGS

By way of example only, one preferred form of the invention will now be described with reference to the accompanying drawings, in which:

Fig 1 shows by diagram the basic operational stages of the machine; and

Fig 2 is a diagrammatic representation of a cooking machine according to this invention.

MODES FOR CARRYING OUT THE INVENTION

The basic components of the cooking machine shown in Fig. 1 are a bottom end wall 1, top end wall 2 and an upright tubular side wall 3. Preferably in a cross-section all of the walls 1, 2 & 3 are circular. As will be seen in the diagram both of the end walls 1 and 2 fit neatly and closely within the tubular side wall 3. Thus when the end walls 1 and 2 are in, for example, respective positions A1 and B2, there is defined between the three walls 1, 2 & 3 a small moulding cavity 7 in which a suitable mixture may be initially compressed and heated.

As will be later described both the end walls 1 and 2 can be moved in various positions axially of the generally cylindrical side wall 3. This movement is produced by pneumatic cylinders.

A further basic component of the device is the food mixture supply mechanism 4. As will be later described mechanism 4 provides a dual purpose, firstly the supply of mixture to be cooked and secondly the removal of cooked rice cakes from the machine. Mechanism 4 is reciprocally movable in a generally horizontal direction and again this movement is provided by pneumatic devices. It will be appreciated that the gap shown

between the side wall 3 and the end walls 1 and 2 is exaggerated for the benefit of clarity of the drawing. In practice this gap will be in the order of some hundredths of a millimeter.

Towards the bottom of end wall 1 is a tapered sealing surface 5. When the end wall 1 is in position A1 (as shown), the tapered surface 5 seals against the internal lip 6 of the side wall 3. This interference sealing between the end wall 1 and side wall 3 not only provides a positive seal at the bottom of the moulding volume but also provides a rigid abutment preventing further movement of the end wall 1 beyond the position A1.

A further basic component of the cooking device is a microprocessor control device (shown in Fig. 2) which receives various signals from a thermo couple indicating temperature within the cavity 7, proximity switches indicating the relative position of movable components, and electronic clocks providing predetermined timing periods. As later described the microprocessor control device maintains the desired cooperation of component movements and cooking cycle. The cooking temperature is maintained between 200°C and 220°C.

In operation the device commences in the general state as shown in Fig. 1. Heating elements within the end walls 1 and 2 raise the temperature of these components until the predetermined temperature is reached within the cavity 7. The mixture supply mechanism 4 then moves above the moulding cavity and introduces a controlled quantity of rice mixture by dropping it upon the floor of the cavity 7 provided by the end wall 1. Upon retraction of the mechanism 4 the end wall 2 is forced down by a pneumatic cylinder so as to compress the rice mixture at a predetermined pressure for from 3 to 5 seconds for initial cooking. During this compression step the rice mixture is fused to form more or less a unit structure. The end wall 2 is then "bounced" by momentarily raising and relowering to position B2 to vent steam via the clearance between the end wall 2 and the side wall 3. The rice mixture is then further cooked within the moulding cavity 7 for a predetermined period of from 3 to 5 seconds. The end wall 2 is then rapidly moved to position B3 where it pauses for another predetermined period of from 0.3 to 0.5 seconds, and preferably 0.4 seconds. This movement is timed to occur at the predicted time of "popping" of the rice grain in the mixture. During this pause at position B3 the volume of the cavity is somewhat larger than it was during the cooking period and the expanded cooked rice cake takes up that volume and

then sets.

Expansion of the rice occurs rapidly due to the "popping" effect of the grain and it is believed that the improved quality of appearance and crispness throughout the rice cake that is achieved is due to precise control of the volume of the cavity 7 at this critical stage and the timing of the end wall movement with the "popping" of the grain. After the pause the end wall 2 is quickly withdrawn from the cavity 7 to position B1 and the end wall 1 is raised to its position A2.

The set and cooked rice cake is then ejected by the horizontal movement of mechanism 4 and thereafter it positions itself for introduction of new rice mixture and a repeat of the above cycle.

During the whole cycle the earlier mentioned heating elements will be periodically energised under control from the control device so as to keep the temperature within an operating range of from 200°C to 220°C.

The manner in which the machine is automatically controlled by the electronic control circuit 8 is shown in Fig. 2. Although not shown in this drawing heating coils are embedded in the upper end wall mould 2 and the lower end wall mould 1, while a thermo couple is connected to the tubular side wall 3. It should be understood that the heating coils and the thermo couple are also connected to the control circuit 8.

A pneumatic cylinder 9 controls the movement of the upper end wall 2 while a pneumatic cylinder 10 controls movement of the lower end wall 1. A further pneumatic cylinder 11 controls movement of the supply mechanism 4. Solenoid valves 12 responsive to the control circuit 8 control operation of the cylinders 9, 10 & 11. The cylinder 11 also, through the mixture supply unit 13, controls dispensing of cookable mixture to the cavity 7 of the mould. A proximity switch 14, connected with the control circuit 8, serves to sense the position of the top end wall 2 within the cavity 7.

In order to achieve the necessary complex movement of the top end wall 2 the cylinder 9 is controlled through a special solenoid valve 15 which is of a 3-positional type having a closed centre or exhaust centre. A suitable solenoid for this purpose is that marketed by SMC Model No. VF5420. The control circuit 8 is programmed whereby all movement of the end walls 1 and 2 is precisely controlled. The necessary timing apparatus for timing of pauses in the movement of the top end wall 2 and the cooking periods, are incorporated within the control circuit 8.

Whereas a preferred embodiment has been described in the foregoing passages it should be understood that other forms, refinements and modifications are feasible within the scope of this invention.

CLAIMS

1. A method of producing a cooked grain-food product such as a rice cake, comprising introducing a cookable mixture for the product into the cavity of a heating mould, applying compression to said mixture by reducing the volume of said cavity, pausing for a first period of time, momentarily increasing the volume of said cavity for the venting of steam, maintaining heating of said mixture for a second predetermined period of time, sharply increasing the volume of said cavity at the completion of said second period, pausing in the increase of said volume for a third predetermined period of time before opening said cavity and then removing the cooked product from said mould.

2. A method according to Claim 1, wherein said mixture is introduced by dropping onto the floor of said cavity, and said floor is elevated upon opening of said cavity to facilitate removal of said cooked product.

3. A method according to Claim 1 or 2, wherein said third period of time is between 0.3 and 0.5 of a second.

4. A method according to Claim 1, 2 or 3, wherein each of said first and second periods of time is between 3 and 5 seconds while said heating of said mixture is maintained at from 200°C to 220°C.

5. A cooked product, such as a rice cake, whenever produced by the method of any one of the preceding claims.

6. A cooking machine for a grain-food product, such as a rice cake, comprising a mould defining a cooking cavity and having a tubular side wall and first and second end walls for closing the ends of said side wall;

power means for independently moving said first and second end walls along the axis of said side wall for variation of the volume of said cooking cavity;

heating means for said mould;

a 3-position solenoid controlled fluid valve controlling said power means for movement of said first end wall; and

an electronic control circuit for controlled energizing of said fluid valve to effect a pause during retraction of said first end wall from said cavity.

7. A cooking machine according to Claim 6, wherein said power means are pneumatic cylinders controlled by solenoid valves energized under control of said control circuit.

8. A cooking machine according to Claim 6 or 7, wherein the axis of said tubular side wall is substantially vertical, and said first end wall is movable downwardly into said cavity.

9. A method of producing a cooked grain-food product substantially as hereinbefore described with reference to the accompanying drawings.

10. A cooking machine for a grain-food product substantially as hereinbefore described with reference to the accompanying drawings.

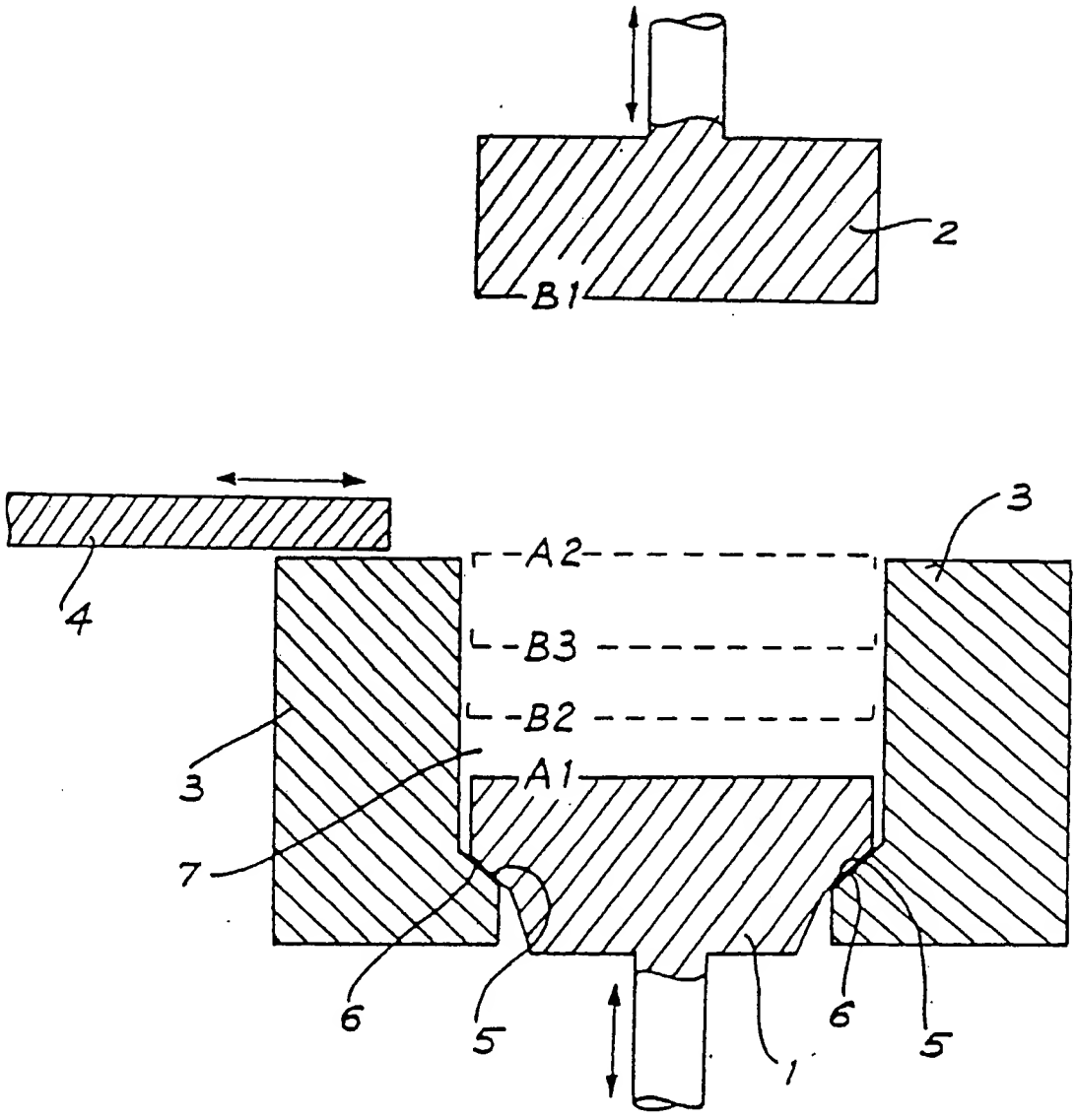


FIG. 1

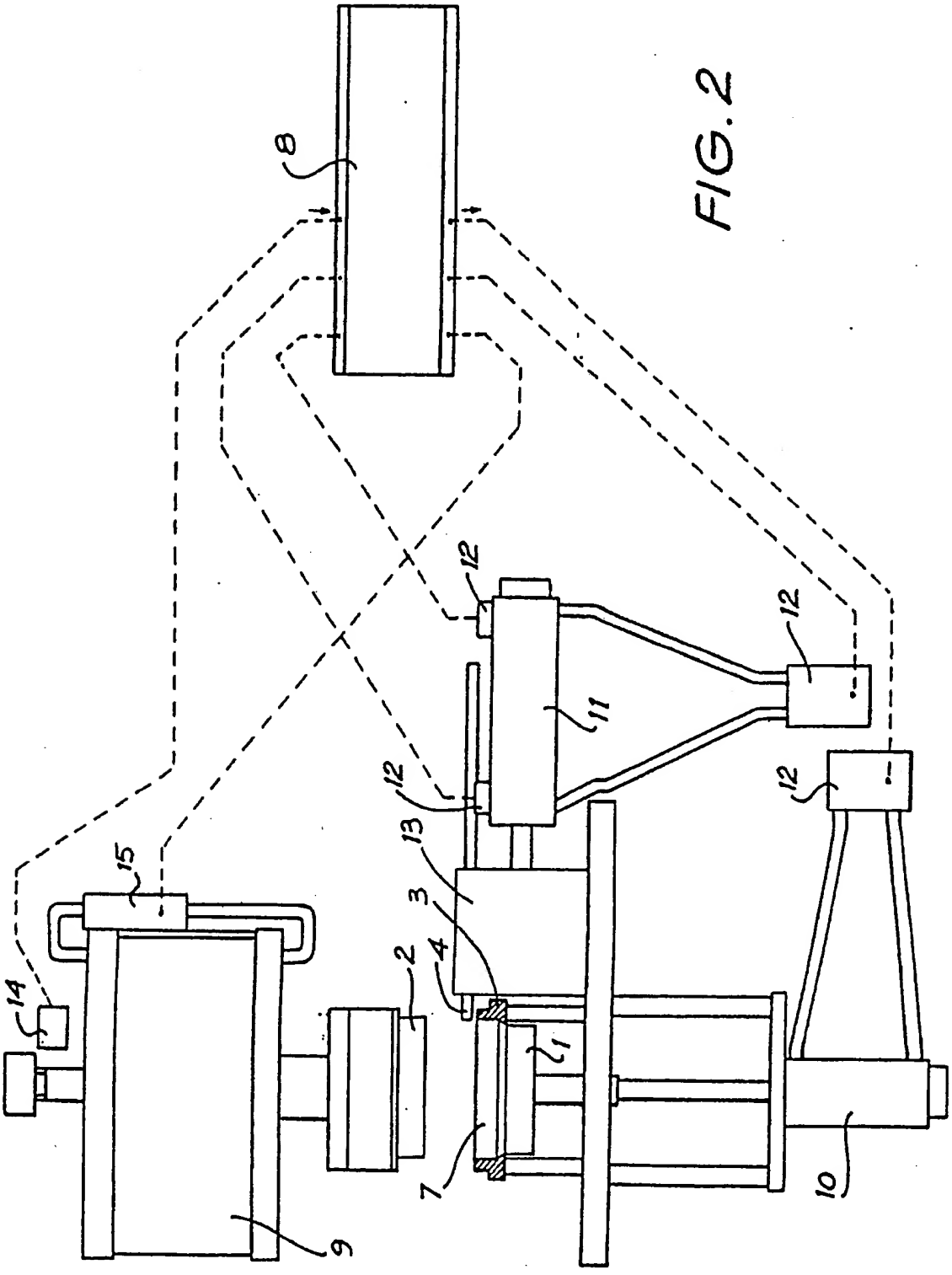


FIG. 2

INTERNATIONAL SEARCH REPORT

International Application No PCT/AU 87/00239

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.[4] A23L 1/10, 1/18, A21B 1/42, 5/02

II. FIELDS SEARCHED

Minimum Documentation Searched

Classification System	Classification Symbols
IPC	A23L 1/10, 1/18, A21B 1/42, 5/02
US Cl.	426/450, 426/445, 426/465

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched

AU : IPC as above; Australian Classification 34.3

III. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	US,A, 4328741 (YOSHIKAZU) 11 May 1982 (11.05.82)	(1-10)
A	AU,A, 48212/85 (KABUSHIKI KAISHA AIRIN) 24 April 1986 (24.04.86)	(1-10)
A	FR,A, 1087548 (GUARDITE CORPORATION) 24 February 1955 (24.02.55)	(1-10)

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
11 November 1987 (11.11.87)	(19.11.87) 19 NOVEMBER 1987
International Searching Authority	**Signature of Authorized Officer**
Australian Patent Office	R.E. Grant (R.E. GRANT)

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON
INTERNATIONAL APPLICATION NO. PCT/AU 87/00239

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Members		
AU 48212/85	DE 3536249	FR 2571592	GB 2165437
	US 4667588		
US 4328741	DE 2950018	FR 2451056	GB 2042421
	GB 2100232	GB 2104489	US 4325626
	US 4390264	US 4444386	AU 58875/80
	CA 1151465	DE 3019798	ES 492048
	FR 2458219	GB 2052240	

END OF ANNEX